SOYBEANS IN CANADA

FORAGE CROP DIVISION
CENTRAL EXPERIMENTAL FARM, OTTAWA

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Growth differences in soybeans.

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SOYBEANS

ORIGIN AND DISTRIBUTION

The soybean is an ancient cultivated plant of China and Japan. It is said to have been introduced on the North American continent during the early years of the eighteenth century. It was not until the beginning of the nineteenth century, however, that it began to establish itself in the agriculture of this continent.

At the present time it is quite extensively grown in approximately a dozen individual states of the United States. In Canada the main areas of production are the central and southwestern portions of the province of Ontario. Small areas have been grown in every province in the Dominion and the increasing interest in this crop, in conjunction with the development of earlier maturing varieties, indicates that the future will see a considerable increase in the production of soybeans in Canada.

DESCRIPTION

The soybean as a species is an erect hairy annual of bushy appearance, ranging in height from one and a half feet to six feet. All of the pods of the soybean mature within a short period of each other so that there is little loss due to immature seed. These pods vary from one-half an inch to two and a half inches in length and are usually yellowish or brown and covered with short bristly hair. As many as several hundred pods may occur on a single plant and each pod usually has two or three seeds. Where growth conditions are favourable for the later maturing varieties it is evident that very profitable yields may be secured.

The flowers, which are small and usually either white or purple in colour, are borne in axillary clusters. Although cross fertilization sometimes occurs between varieties planted close together the flowers of the soybeans are usually self fertilized.

The leaves are tri-foliate. Varieties of soybeans differ considerably in their tendency to retain the leaves until the pods are mature. A large number of varieties lose the majority of their leaves before the pods are mature. However, several varieties retain their leaves until after the normal harvesting time of the plant.

The soybean has a strong tap root with numerous rootlets. Given suitable environmental conditions and the proper bacteria the roots of the soybean have a plentiful supply of nodules.

CULTURE

Soil

Soybeans succeed on almost any type of soil but do best on sandy or clay loams in a good state of fertility. In general the soil requirements are about the same as for corn. Drainage should be reasonably good although soybeans will stand both excessive moisture or drought better than corn.

A soil too acid for clover will often produce good crops of soybeans.

Soil Preparation

Soybeans, like all other crops, must have a good seedbed to give the best results. Ploughing should be done in the fall or as early as possible in the spring and the land thoroughly worked by disking and harrowing until a fine smooth seedbed is ready at planting time. Proper preparation at this time will largely overcome the weed menace later in the season.

Inoculation of Seed

Soybeans like other legumes, such as clovers, alfalfa, etc., are able to take nitrogen from the air through the action of bacteria which live on the roots of the plant. The presence of these organisms is indicated by the development of nodules on the roots. The bacteria present in the nodules on soybeans are to be found on soybeans only. This means that the seed of soybeans can be inoculated only with the soybean organism and this should be done wherever this crop is to be grown in a field for the first time.

The necessary bacteria may be introduced into the soil in several ways. The most common methods are as follows: (1) the application of pure cultures of the required bacteria to the seed just previous to planting; (2) transferring soil from an inoculated field to the field being sown (200-500 pound per acre); (3) sprinkling inoculated muddy water over the seed and then stirring thoroughly so that every seed has soil particles adhering to it. For this purpose inoculated soil is mixed with water until the consistency of cream is reached. After the seed is slightly moistened it may be sown without waiting for it to dry.

In inoculating soybeans care should be taken not to soak the seed as this will result in it becoming swollen and causing trouble at the time of planting. Damage might also result from the seed coat becoming wrinkled and peeling off.

Sufficient culture to make a trial inoculation on a practical scale may be obtained free of charge by farmers who write to the Division of Bacteriology, Central Experimental Farm, Ottawa, Ontario. The culture, along with directions for making the inoculation, is sent to each applicant with the understanding that he reports the result of his inoculation test.

Nitro-cultures may also be obtained at a nominal charge from some of the provincial agricultural colleges, or from various commercial concerns.

Time to Seed

Soybeans may be sown any time after the danger of severe frost is over. In general the time to plant is about the same as that for corn. Nothing is gained by seeding before the soil has become well warmed up.

Method of Seeding

Soybeans are sown in the same manner as the cereal grains, either in rows or drilled. The latter method results in the production of a finer quality of hay and in addition requires no cultivation.

Row planting is the method generally used and the ordinary grain drill furnishes a very convenient means for seeding in this way. The width of rows can be adjusted by covering the feed cups not in use.

The rows are usually spaced about twenty-eight to thirty-two inches apart with the plants about three inches apart in the rows. This requires about thirty pounds (one-half bushel) of seed per acre while about one and one-quarter bushels of seed per acre is required where the seed is drilled in.

The depth of planting the seed is important and depends largely upon the nature of the soil and its preparation. Where a good seed bed has been prepared and there is a good supply of moisture in the soil an average depth of two inches should be sufficient.

Providing the land is reasonably clean to begin with two or three cultivations should be sufficient to keep down the weeds where the crop is grown in rows.

About the time that the beans are coming through the ground it has been found to be good practice to go over the new planting with the spike-tooth harrow in order to break any crust that may have formed

Being a cultivated crop soybeans might be used to some extent as a substitute for the corn crop in the corn borer infested area. By growing the proper varieties the crop will be harvested just previous to the time for sowing fall wheat which may be sown in the soybean stubble with the minimum of soil preparation.

HARVESTING

For Hay

Soybeans may be cut for hay any time after the pods have developed until the leaves begin to turn yellow. Results have indicated, however, that the best time to cut is when the pods are well filled, for at this stage the highest yield and best quality of hay is obtained.

Soybeans are commonly cut with a mower and left in the swath for about a day, or until the leaves are thoroughly wilted. They may then be raked into windrows and allowed to cure or, after two or three days in the windrows, put into small cocks.

The hay should be thoroughly cured before hauling and handled in such a way as to preserve the leaves as much as possible.

For Seed

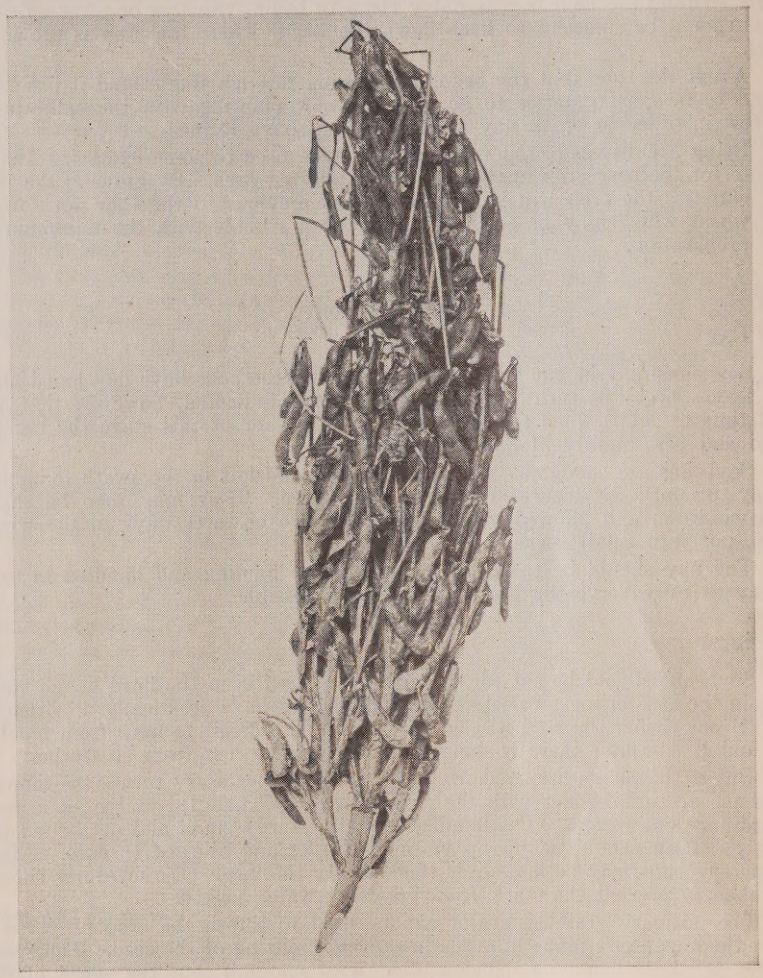
Soybeans should be cut for seed when the seed is in the hard dough stage and, in the case of most varieties, when the leaves have practically all dropped off. If cut earlier the seed will be immature and difficult to keep from moulding and if cut later there is danger of considerable loss from shattering.

Unless the plants are so short that it becomes necessary to use the mower, soybeans are usually cut with the grain binder and handled in the same way as ordinary grain crops. The bundles should be fairly small and not bound too tightly. They should be set up in small shocks and allowed to cure. After curing soybeans may be housed or stacked. In the latter case measures should be taken to prevent the stack from becoming water soaked.

The ordinary grain separator can be used to thresh the crop provided a few adjustments are made in order to prevent splitting of the seed. The speed of the cylinder should be reduced to at least one-half, but the speed of the remainder of the machine must be maintained. This may be accomplished by doubling the size of the cylinder pulleys. The first concave should be removed and a wooden blank put in and some of the teeth should be removed from the second concave.

Small lots of soybeans may easily be threshed by hand when the pods are thoroughly dry.

After threshing the beans should be stored in such a way that if heating occurs they may be easily turned. Improper storage may easily result in impaired germination.



A heavy seed producer.

USES OF SOYBEANS

Plant

The soybean plant may be used for a variety of purposes, namely, green manure, soiling, ensilage, hay and pasturing. In common with other legumes, soybeans ploughed down constitute one of the best crops for increasing soil productivity but the value of the crop makes its use for this purpose hardly practicable except under special conditions.

Ensilage

Soybeans alone do not make the best ensilage. Results have indicated that soybeans and corn make an excellent silage combination and for this purpose the two crops may be grown together or grown separately and mixed at the time of ensiling in the proportion of approximately three parts corn to one part soybeans.

Hay

Soybean hay is relished by all classes of live stock and is shown by analysis and feeding tests to be equal in value to red clover or alfalfa hay. Having a high content of digestible protein it can be used to reduce the amount of costly concentrated feeds.

Being an annual legume soybeans can be grown for hay in the event of clover or alfalfa failure.

Pasture

Soybeans make satisfactory pasture for all classes of live stock.

When bad weather or other conditions interfere with harvesting, the crop may he hogged off and used to supplement the corn ration.

Straw

The straw obtained from threshing has a definite feed value and can be fed to all classes of live stock. Fed in addition to concentrated feeds it has given better results than corn stover fed in a similar manner.

Seed for Feed

Soybean seed differs from the seed of other legume crops, such as field peas and beans and cowpeas, chiefly in its higher content of protein and oil and its lower content of starch. This makes it a very highly concentrated feed and explains the reason why care should be exercised in feeding soybeans to stock.

As a supplement to corn in the ration soybeans have given excellent results, especially in feeding hogs but the feeding of them alone in large quanties is not recommended.

Seed for Oil

The seed of soybeans contains on an average approximately 17.5 per cent of oil. This has been found suitable for various commercial uses. It is now extracted on a very large scale in China and Japan and also in the United States, and is used extensively in the manufacture of soaps, paints and various food products.

Canada has imported annually, during the last seven years, an average of about 5,000,000 pounds of soybean oil for use in the manufacture of soaps and paints. One ton of soybeans yields approximately two hundred and forty pounds of oil. A ton of soybeans would be an extremely good yield per acre so that the above quantity of oil represents the product of at least twenty thousand acres of soybeans.

In addition, the cake or meal resulting from the extraction of oil from soybeans has a feeding value equal to that of linseed meal or cotton seed cake. It is being imported into Canada at present in considerable quantities for feeding purposes.

DESCRIPTION OF VARIETIES

The following is a description of the seed and plant characters of the different varieties grown in the tests at the Dominion Experimental Station, Harrow, Ontario and listed in the accompanying table:

Ste. Anne's No. 92

Seed.—Colour—maize yellow; dark brown hilum with dark brown collar.
Seeds per ounce.—135.
Plant.—Erect, bushy. Leaf stems long, bearing the leaves high above tip of main stem. Leaf blight infection—light to medium heavy.

Early Brown

Seed.—Colour—cinnamon brown; dark brown hilum.
Seeds per ounce.—116.
Plant.—Erect, bushy. Leaves extend above tip of main stem similar to Ste. Anne's No. 92. Leaf blight infection—very light to light.

Mandarin

Seed.—Colour—buff yellow; yellow hilum.
Seeds per ounce.—133.
Plant.—Erect, bushy. Tip of main stem extends above leaves giving plant conical shape and appearance of being more spreading at the base. Leaves very dull green in colour. Leaf blight infection—practically nil.

Yellow 210

Seed.—Colour—buff yellow; yellow hilum.
Seeds per ounce.—110.
Plant.—Erect, bushy. Somewhat similar in appearance to Mandarin but tip of main stem not extended to same extent. Leaf blight infection—practically nil.

Yellow 17

Seed.—Colour—maize yellow with black saddle; black hilum.
Seeds per ounce.—128.
Plant.—Erect bushy. Very compact bushy type. Leaves have decided glossy appearance. Leaf blight infection—practically nil.

Chinaton Echo

Seed.—Colour—light cress green; black hilum.
Seeds per ounce.—180.
Plant.—Erect, bushy. Plant has conical appearance due to tip of main stem being extended above leaves. Leaf blight infection—practically nil.

Italian

Seed.—Colour—buff yellow; dark brown hilum with dark brown collar.
Seeds per ounce.—128.
Plant.—Erect, bushy. Leaves slightly extended above and around tip of main stem. Leaf blight infection—light to medium heavy.

O.A.C. No. 211

Seed.—Colour—buff yellow; yellow hilum.
Seeds per ounce.—130.
Plant.—Erect, bushy. Tip of main stem somewhat extended giving conical shape with branches spreading fairly widely at base of plant. Leaf blight infection—practically nil.

O.A.C. No. 81

Seed.—Colour—buff yellow; dark brown hilum with dark brown collar.
Seeds per ounce.—140.
Plant.—Erect, bushy. Leaves extended above tip of main stem. Leaf blight infection—light to medium heavy.

SUMMERLAND

Seed.—Colour—buff yellow; yellow hilum; brown spot at micropyle.
Seeds per ounce.—157.
Plant.—Erect, bushy. Leaves extended above tip of main stem. Leaf blight infection light to medium heavy.

BLACK (CHINA)

Seed.—Colour—black; black hilum.
Seeds per ounce.—139.
Plant.—Erect, bushy. Tip of main stem somewhat extended above leaves. Branches close to ground and somewhat spreading. Leaf blight infection—practically nil.

EARLY KOREAN

Seed.—Colour—buff yellow; black hilum.
Seeds per ounce.—114.
Plant.—Erect, bushy. Leaves extended above tip of main stem. Leaf blight infection —practically nil.

GREEN

Seed.—Colour—mignonette green; black hilum.
Seeds per ounce.—100.
Plant.—Erect, bushy. Leaf stems long, extending leaves considerably above tip of main stem. Leaves large giving plant very leafy appearance. Leaf blight infection—very light to light.

MANCHU

Seed.—Colour—maize yellow; black hilum.
Seeds per ounce.—140.
Plant.—Erect, bushy. Tip of main stem somewhat elongated above leaves. Leaf blight infection—practically nil.

BLACK EYEBROW

Seed.—Colour—buckthorn brown with black saddle; black hilum.
Seeds per ounce.—138.
Plant.—Erect, bushy. Tip of main stem extended slightly above leaves and somewhat twining. Leaf blight infection—practically nil.

ITO SAN

Seed.—Colour—buff yellow; yellow hilum; brown spot at micropyle.
Seeds per ounce.—152.
Plant.—Erect, bushy. Leaves extended slightly above and around tip of main stem. Leaf blight infection—light to medium heavy.

GOLDEN

Seed.—Colour—buff yellow; yellow hilum.
Seeds per ounce.—132.
Plant.—Erect, bushy. Leaves extended slightly above and around tip of main stem. Leaf blight infection—practically nil.

A.K.

Seed.—Colour—maize yellow; light brown hilum.
Seeds per ounce.—185.
Plant.—Erect, bushy. Leaves extended slightly above and around tip of main stem. Branches erect without much spread. Leaf blight infection—practically nil.

YIELDS

The following table gives the average yields of hay and seed obtained over a period of three to four years, along with the maturity group and height of each variety.

SOYBEANS—VARIETY TEST

Average Maturity, Height and Yield per acre for four years (1924-1927)

Variety	Maturity group	Height		Yield per acre	
				Hay	Seed
		Ft.	Ins.	Tons Lb.	Bush.
Ste Anne's No. 92	1	1	4	1 649	20·40
*Early Brown	1	1	7	1 838	22·75
†Mandarin	1	1	7	1 1,145	27·10
Yellow 210	2	1	8	1 1,155	27·69
Chinaton Echo	2	1	10	1 1,608	26·26
O.A.C. No. 81	2	1	11½	1 1,967	28·66
Black (China)	2	1	8½	1 1,749	24·95
Yellow 17	2	1	11½	1 1,947	29·74
Summerland	2	2	2	1 1,994	23·31
†Italian	2	2	0½	2 552	34·76
†O.A.C. No. 211	2	1	10	2 258	32·47
Ito San	3	2	5	2 598	31·69
Manchu	3	2	4	2 492	35·39
Black Eyebrow	3	2	4	2 442	36·13
Green	3	1	9	2 67	34·92
Early Korean	3	2	1	2 216	34·98
Golden	3	2	2	2 624	36·53
†A.K	3	2	9	2 1,262	39·75

Hay contains 15 per cent moisture. Seed contains 12 per cent moisture.
*Averages for two years only (1926-1927).
†Averages for three years only (1925-1927).

While the foregoing table includes only a small portion of the known soybean varieties it does contain those that are most commonly grown in Canada at the present time, along with a number which have not as yet been included in general plantings. The different maturity groups are separated by intervals of one week. Within each group the plants are arranged in order of their earliness. For example Ste. Anne's No. 92 is earlier in maturity than Mandarin and Yellow 210 is earlier than O.A.C. 211.

All of the varieties included in the accompanying table were planted in single row plots repeated nine times in order that we might obtain some idea of the variation that existed within different plantings of the same variety. This variation was figured out mathematically within single varieties and amounted to a little less than ten per cent. In making comparisons between varieties it would, therefore, seem reasonable to conclude that differences of less than ten per cent might not be significant while differences greater than ten per cent would be expected to be due to an increased capacity to yield rather than to soil variations or some other experimental error. In comparing the first and last varieties in the first maturity group with regard to their yield of seed per acre we notice that Ste. Anne's No. 92 has given an average of 20.4 bushels per acre while the Mandarin variety has given an average of 27.10 bushels per acre. The difference in favour of Mandarin is 6.7 bushels an increase of well over thirty per cent. Such an increase is definitely significant. The difference between the yield of Mandarin and Chinaton Echo on the other hand is only 0.84 of a bushel which could not be considered as indicating that the Mandarin variety was a better yielder than the Chinaton Echo.

On the whole the later varieties have yielded higher than the earlier ones. Within each group however, there is a significant difference between the yielding capacity of varieties for both hay and seed. It should be possible, therefore, for a grower to pick out the highest yielding variety in any particular maturity group.

Variations in maturity.

It is interesting to note that although the land on which the soybean test was carried out was not exceptionally productive, the yield of both hay and grain was quite high. The yield of hay particularly averaged over one and a half times the five year average yield of hay and clover reported by the Bureau of Statistics for the whole of Canada.

In districts where soybeans have not been previously grown it would be advisable for the prospective grower, before going extensively into this crop, to test several varieties representing a range in length of growing season in order to ascertain the possibilities of the district under consideration.

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